United Nations Industrial Development Organization

Distr.
LIMITED

ID/WG.440/6/Add.1
8 July 1985

ENGLISH
ORIGINAL: SPANISH

Regional Meeting for the Initiation of a
Regional Network for Microelectronics
in the ECLAC Region

Caracas, Venezuela, 3-7 June 1985

REPORT ON THE UNIDO MISSION PREPARATORY TO THE ESTABLISHMENT OF A REGIONAL SYSTEM FOR MICROELECTRONICS IN LATIN AMERICA *

Annexes

I. Programmes connected with microelectronics.

II. Places visited.

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ANNEX I

Programmes connected with microelectronics

VENEZUELA

The microelectronics industry in Venezuela arose from the activities of the Venezuelan Institute of Scientific Research (IVIC) which had, from its inception in the early 'sixties, an electronics group working on instrument design to back up the research done at the institute. This group was the origin of virtually all research and development groups working in Venezuela, as well as a fair number of the country's electronics companies.

If we define microelectronics as being concerned solely with electronic components, then work on microelectronics is conducted mainly in the research and development institutes, since the principal advances on an industrial scale have stemmed from the design of electronic equipment.

The activities and staff of the research and development institutes are as follows:

ENGINEERING INSTITUTE FOUNDATION (FII)

(26 research and development specialists)

(a) Hybrid circuits
(b) Components for integrated circuits and transistors
(c) Fibre optics communication systems
(d) Local micro-computer networks
(e) Micro-processor surveillance systems
(f) Manufacture of solar cells and panels
(g) Telemetry systems
(h) Computer-aided design.

VENEZUELAN INSTITUTE OF SCIENTIFIC RESEARCH (IVIC)

(3 research and development specialists and 1 electronic engineering post-graduate)

(a) Integrated circuits and components
(b) Ferroelectric materials
(c) Solar cells.

SIMON BOLIVAR UNIVERSITY

(6 research and development specialists)

(a) Solar cells
(b) Growth of mono-crystalline silicon
(c) Micro-processor applications.

LOS ANDES UNIVERSITY

(a) Materials for solar cells.

In addition to these activities, there are development laboratories attached to State undertakings such as the Venezuelan Telephone Company (CANTV) and the Venezuelan Petroleum Technology Institute (INTEVEP), which look into developments for their respective establishments.

Finally, there is a growing number of Venezuelan electronics companies which produce high added value equipment and/or components for this equipment. They currently manufacture the following products:

(a) Printed circuits
(b) Data capture systems
(c) Voltage regulators and line protectors
(d) Transformers
(e) Telex-computer interfaces
(f) Surveillance and monitoring systems
(g) Lift control systems
(h) Modems
(i) Telephone exchanges
(j) Telephone equipment including handsets
(k) Taximeters
(l) Electronic watches
(m) Data consoles
(n) Subscriber identification systems
(o) Personal computers.

These firms employ about 400 staff, more than half of whom are professional specialists and technicians.

BRAZIL

Of all the countries visited Brazil undoubtedly has the most extensive infrastructure, as regards both research and development activities and industrial capability. Owing to the shortness of the stay, it was only possible to visit some of the organizations actively working on microelectronics, mainly those in the region of São Paulo and Campinas.

Microelectronics in Brazil goes right back to 1965 at São Paulo University and the Physics Institute. The microelectronics laboratory was set up in 1970 and there was a lot of work done on microelectronics at Telebras and Campinas University in 1972. The Transit company was established in 1973 to manufacture diodes and transistors, but it was unsuccessful because its headquarters were far from the main industrial and academic centres.

In 1979 Brazil began to establish a general policy for the data processing sector through the Special Data Processing Department, which promoted the promulgation of the law on data processing. This law led to the establishment of the Data Processing Technology Centre (CTI) at Campinas.

It would be difficult to present a complete summary of microelectronics activity in Brazil and we shall therefore only mention a few areas of work at the organizations visited.

DATA PROCESSING TECHNOLOGY CENTRE (CTI)

(400 research and development specialists)

This recently-established Centre has four institutes, one of which deals with microelectronics. The Microelectronics Institute is involved in:

(a) Assembly of components and circuits
(b) Assembly testing
(c) Computer circuit design

(d) Mask design and manufacture
(e) Circuit metal deposition
(f) C-MOS n-well and integrated cell components
(g) Integrated circuit manufacturing processes.

The Centre also co-ordinates activities, promoting co-operation between universities, defining priorities and providing a technological base for industry. The main emphasis is placed on developing areas which are not covered by industry as support for the latter.

UNICAMP

Attention at UNICAMP is primarily focussed on aspects connected with the manufacture of fibre optics components and devices. The solid state laser and fibre optics developments made by this University have already found industrial application and further research is being conducted into solid state lasers.

SÃO PAULO UNIVERSITY

(34 research workers plus students and technicians)

(a) Growth of mono-crystalline silicon
(b) Computer-aided design
(c) Diffusion processes for integrated circuits
(d) Solar cells
(e) MOS integrated circuits
(f) Thin layer hybrid circuits.

TELEBRAS

(a) Computer-aided design for integrated circuits
(b) Thick layer hybrid circuits
(c) GaAs solid-state lasers.

Some outstanding examples of the work being done in Brazil are:

1. There are computer-aided design groups working on integrated circuits at CTI, USP, Telebras, Río Grande, Itaucom and SID.

2. There is an industrial plant for the production of mono-crystalline silicon (heliodynamic process).

3. There is a transistor production plant (AEGIS).

4. The SID company produces linear and digital integrated circuits at prices that are competitive on the international market and is beginning to work on gate arrays and standard cells.

5. There are about 180 Brazilian companies whose production ranges from the components described above to mini-computers and there are various plants manufacturing personal computers, telephone exchanges, etc.

ARGENTINA

BUENOS AIRES UNIVERSITY

(15 research and development specialists)

(a) Electrical properties of semi-conductors and piezo-electric devices.

ARMED FORCES TECHNOLOGY CENTRE (CITEFA)

1. National Centre for Electronic Component Research (CENICE)

(47 research and development specialists)

(a) Thick layer hybrid circuits
(b) Pilot plant for bipolar technology
(c) Computer-aided design of integrated circuits
(d) Quality control
(e) CMOS pilot plant.

2. Solid state research programme

(24 research and development specialists)

(a) Growth and assessment of infra-red detection compounds
(b) Solid state batteries.

3. CEILAP

(35 research and development specialists)

(a) Research into lasers and optics.

NATIONAL UNIVERSITY OF THE COAST (Universidad Nacional del Litoral)

(32 research and development specialists)

(a) Electrical and magnetic properties of non-ordered semi-conductors
(b) Silicon technology
(c) Solar cells
(d) Electronic grade chloroxylenes and ultra-pure gases.

NATIONAL UNIVERSITY OF THE SOUTH (Universidad Nacional del Sur)

(9 research and development specialists)

(a) Fibre optics
(b) Liquid crystals.

BARILOCHE ATOMIC CENTRE (CNEA)

(24 research and development specialists)

(a) Ion implants
(b) Growth of semi-conductor crystals
(c) Ferroelectric ceramic and piezo-electric transducers.

NATIONAL INSTITUTE OF INDUSTRIAL TECHNOLOGY (INTI)

(a) Metrology
(b) Micro-processors
(c) Development of telephone exchanges
(d) Quality engineering
(e) Numerical control
(f) Sensors and instrumentation.

MEXICO

Mexico is extremely interested in participating in REMLAC. This was made clear by Dr. José Warman, the Director for the Electronics Industry and Industrial Co-ordination at the Ministry of Commerce and Industrial Promotion, who stressed the fact that the Mexican Government had been supporting the idea of a regional microelectronics meeting for over three years and that there is even greater interest today because of the progress that has been made in this field.

Both the representatives of industry, such as the Chairman of the Mexican Chamber of the Electronics Industry and Electrical Communications (CANIECE), and research workers were also positive in their opinions since they appreciate the advantages of establishing better communications with other countries in the area and of developing joint projects.

Work on electronics in Mexico has speeded up considerably in recent years. Industry has expanded rapidly into manufacturing and technological development and engineering, principally in the fields of telecommunications, data processing, professional electronics and consumer goods.

In telecommunications there have been ambitious programmes to digitalize telephone exchanges and to extend the micro-wave and satellite communications networks. Progress in data processing is such that there are now over 80 Mexican producers of micro-computers, peripherals and components, as well as the manufacturers operating on the contractual buy-back principle ("maquiladores") and producing for the export market. In the field of professional electronics, using national technology, dozens of products have been developed that are advantageously competing with foreign items. As far as consumer goods are concerned, Mexico has begun the domestic production of television sets and radio receivers as a means of competing effectively with contraband imports. Domestic production has also been achieved in such areas as printed circuits and components, including transistors and resistors, under internationally competitive quality and price conditions.

Furthermore, in the research and development area, there are already important telecommunications groups, both in industry (the Telecommunications Development Institute (INDETELEC), Teléfonos de Mexico, etc.) and at governmental institutes and centres of higher education (the Telecommunications Research and Development Centre (CIDET), the Centre for Research and Advanced Studies of the National Polytechnical Institute (CINVESTAV), the Engineering Faculty of the National Autonomous University of Mexico (UNAM) and the new Telecommunications Institute, among others). In the field of data processing as well groups have been formed in industry (MEXEL, IBM, NCR, etc.) and at institutes, such as CINVESTAV, the Institute for Research in Applied Mathematics, Systems and Services (IMASS), the Instrument Centre, the University Computation Programme (these last three at UNAM), the Institute of Electrical Research (IIE), the Mexican Petroleum Institute (IMP), etc. In professional electronics there have been developments in many industries, the majority in collaboration with such institutes as IIE, IMP, the regional technological institutes, the Autonomous Metropolitan University (UAM), the Institute of Engineering at UNAM and others. Work is also going forward in computer-aided design and computer-aided manufacturing at many of these institutes. Component-associated research and development is concentrated at the institutions of higher education, among which particular mention should be made of the University of Puebla, CINVESTAV, the Institute of Physics and the Institute of Materials of UNAM, as well as the National Institute of Astrophysics, Optics and Electronics (INAOE). This work is primarily concerned with silicon (polycrystal, monocrystal and amorphous) and with the design and production of integrated circuits.

At practically all the groups mentioned there is a previous history of collaboration with other Latin American countries, particularly through visits, information exchanges and participation in regional technical meetings.

There is an awareness of the inadequacy of co-operation in the micro-electronics area between the research groups and industry. This is due primarily to the fact that industrial development in this field is still in its infancy and the groups engaged in the design and development of equipment and devices have not displayed an interest in the more extensive use of customized and semi-customized integrated circuits. But this trend, which is becoming daily more evident in countries like the United States of America, is beginning to make itself felt and there is already a keen interest in the establishment of an electronics industry support centre to facilitate the work of design, co-operation with silicon foundries and, in general, prototype development and evaluation.

The Mexican Government is directing particular attention to the development of the electronics industry and, to this end, is preparing a comprehensive programme for the development of the electronics industry (PIDIE), which will supplement the growth that has already been achieved in recent years by promoting industries, mainly in the computer area, and by extending coverage to professional electronics, consumer electronics, bio-medical electronics, micro-electronics and software.

This programme includes the encouragement of electronics production through conventional measures of promotion in co-ordination with the development of applications of interest to the quasi-governmental sector, which is also expected to participate in and support the growth of new electronics industries. The strategy adopted envisages a series of measures of a scientific and technological nature that are to be carried out in concert with industry and the country's research and development community for the purpose of facilitating industrial activities in this field. Among these measures there are plans to strengthen the research and development groups capable of generating electronic applications and to create technological support services to work together with industry in the design development and production of prototypes and in technological support for the industrial-scale manufacture of this equipment.

To this end, there is to be a restructuring of the service centre already mentioned, which will draw on the support of the quasi-governmental sector and private enterprise. This centre is being organized with the support of the Ministry of Commerce and Industrial Promotion (SECOFI), the Ministry of Energy, Mining and Quasi-Governmental Industry (SEMIP), the Institute of Electrical Research and the Chamber of the Electronics Industry and Electrical Communications. By virtue of its functions, this centre will represent an appropriate nodal point for the REMLAC System.

Abbreviations

CIDET	Telecommunications Research and Development Centre. It is part of the Ministry of Communications and Transport.
CINVESTAV	Centre for Research and Advanced Studies of the National Polytechnical Institute.
IMASS	Institute for Research in Applied Mathematics, Systems and Services. It is subordinate to the National Autonomous University of Mexico (UNAM).
IIE	Institute of Electrical Research.
IMP	Mexican Petroleum Institute.

UAM	Autonomous Metropolitan University.
INAOE	National Institute of Astrophysics, Optics and Electronics.
SECOFI	Ministry of Commerce and Industrial Promotion.
SEMIP	Ministry of Energy, Mining and Quasi-Governmental Industry.
CANIECE	National Chamber of the Electronics Industry and Electrical Communications.

ANNEX II

Places visited

BRAZIL

UNIDO
Special Data Processing Department
Data Processing Technology Centre
Telebras
ABC-XTAL
UNICAMP
ITAUCOM
SID
AEGIS
University of Sao Paulo
Heliodinamica

ARGENTINA

UNIDO
INTI
CITEFA
CENICE
Department of Science and Technology
National Electronics Programme

VENEZUELA

Engineering Institute Foundation
Venezuelan Institute of Scientific Research
CAFADAE
MICROTEL
XYNERTEK